California Transportation: Current Practices, Challenges & Opportunities

May 17, 2017

Transportation Research Board
Future Interstate Study Committee

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

Caltrans, District 4 – Traffic Operations
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Outline

1. Background
2. Current Practices
   - Transportation Management System
   - Incident & Emergency Management
   - Freeway Operations
   - Commercial Vehicles Operations
   - Pedestrians & Bicycles
   - Transit & Rail
   - California Connected Vehicle Test Bed
3. Challenges
   - Population, Housing, Jobs, and Transportation
   - Climate Change
   - Funding
4. Opportunities
   - California Senate Bill 1 (2017)
   - Asset Management
   - California Connected Corridors
   - Express Lanes Network
   - Connected/Autonomous Vehicles
   - Next Steps
   - Predictions, Anyone?
5. Questions
   - Appendix
Highway Traffic Congestion

- Annual Highway VMT: ± 330 billion, growing at >2% per year
- Three of the US Top 20 Most Congested Urban Regions Los Angeles; San Francisco; and San Diego
- Average Daily Vehicle Hours of Delay: BIG!
Caltrans: Owner and Operator of the State Highway System

- Responsible for > 50 K lane-miles of highways
  - Planning
  - Design
  - Construction
  - Operation
  - Maintenance
- Operates Inter-city rail services
- Permits > 400 public and special use airports and heliports
- Partners with regional and local agencies
  - 19 MPO’s
  - 58 Counties
  - > 500 Incorporated Cities
- 12 Districts
Caltrans - District 4
San Francisco Bay Area

• District 4 encompasses nine San Francisco Bay Area counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Solano, Sonoma, and Santa Clara

• About 2,900 positions with an annual operating budget of over $460 million

• Manages about 6,500 lane miles on over 770 centerline miles of conventional highways and 690 centerline miles of freeways, including 494 miles of managed lanes (HOV and Express Lanes)

• Owns/Operates seven toll bridges: Antioch, Benicia-Martinez, Carquinez, Richmond-San Rafael, San Mateo-Hayward, San Francisco-Oakland and Dumbarton

• 156 projects in construction for $1.56 B

• FY 16/17 Contract for Delivery: 48 projects for $349 M
## California State Highway System

<table>
<thead>
<tr>
<th>Inventory</th>
<th>Statewide</th>
<th>District 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lane Miles</td>
<td>50,000</td>
<td>6,468</td>
</tr>
<tr>
<td>Bridges</td>
<td>12,559</td>
<td>2,500</td>
</tr>
<tr>
<td>Acres of Landscape</td>
<td>29,000</td>
<td>4,600</td>
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<tr>
<td>Culverts</td>
<td>205,000</td>
<td>43,059</td>
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<tr>
<td>Roadside Rest Area</td>
<td>87</td>
<td>3</td>
</tr>
<tr>
<td>Park &amp; Ride Lots</td>
<td>325</td>
<td>46</td>
</tr>
<tr>
<td>Vista Points</td>
<td>146</td>
<td>20</td>
</tr>
<tr>
<td>Traffic Signals</td>
<td>6,263</td>
<td>1,441</td>
</tr>
<tr>
<td>Vehicle Miles of Travel, Billion Miles</td>
<td>148</td>
<td>31</td>
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<tr>
<td>2014 Collisions* Total (Fatal + Injury)</td>
<td>94,539(49,884)</td>
<td>28,110 (9,583)</td>
</tr>
<tr>
<td>2016 Congestion Delay*, Million Vehicle Hours</td>
<td>305</td>
<td>73</td>
</tr>
</tbody>
</table>

* TASAS and PeMS Preliminary Data, State Highways only
California 2016 Congestion by Caltrans Districts
(Delay at 60 MPH)

Source: PeMS 2016

D7 - LA/Ventura
43%

D4 - Bay Area
24%

D12 - Orange County
10%

D11 - San Diego/Imperial
8%

D10 - Central
1%

D8 - San Bernardino/Riverside
8%

D3 - North Central
4%

D5 - Central Coast
1%

D6 - South Central
1%

INRIX 2016 Traffic Scorecard

<table>
<thead>
<tr>
<th>Rank</th>
<th>City</th>
<th>Peak Hours Spent in Congestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Los Angeles, CA</td>
<td>104</td>
</tr>
<tr>
<td>2</td>
<td>New York, NY</td>
<td>89</td>
</tr>
<tr>
<td>3</td>
<td>San Francisco, CA</td>
<td>83</td>
</tr>
<tr>
<td>4</td>
<td>Atlanta, GA</td>
<td>71</td>
</tr>
<tr>
<td>5</td>
<td>Miami, FL</td>
<td>65</td>
</tr>
<tr>
<td>6</td>
<td>Washington, DC</td>
<td>61</td>
</tr>
<tr>
<td>7</td>
<td>Dallas, TX</td>
<td>59</td>
</tr>
<tr>
<td>8</td>
<td>Boston, MA</td>
<td>58</td>
</tr>
<tr>
<td>9</td>
<td>Chicago, IL</td>
<td>57</td>
</tr>
<tr>
<td>10</td>
<td>Seattle, WA</td>
<td>55</td>
</tr>
</tbody>
</table>

Source: PeMS 2016
# San Francisco Bay Area Freeway Congestion Costs, 2016

<table>
<thead>
<tr>
<th>San Francisco Bay Area County</th>
<th>Period</th>
<th>Vehicle Hours of Delay (VHD)</th>
<th>Lost Time, $ (VHD x 15.7/hr)</th>
<th>Wasted Fuel, $ (VHD x 1.719 x 2.727)</th>
<th>Total Cost, $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alameda</td>
<td>Annual</td>
<td>24,983,000</td>
<td>392,233,000</td>
<td>117,113,000</td>
<td>509,346,000</td>
</tr>
<tr>
<td></td>
<td>Daily</td>
<td>68,000</td>
<td>1,075,000</td>
<td>321,000</td>
<td>1,395,000</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Annual</td>
<td>16,843,000</td>
<td>264,435,000</td>
<td>78,955,000</td>
<td>343,390,000</td>
</tr>
<tr>
<td></td>
<td>Daily</td>
<td>46,000</td>
<td>724,000</td>
<td>216,000</td>
<td>941,000</td>
</tr>
<tr>
<td>Contra Costa</td>
<td>Annual</td>
<td>10,229,000</td>
<td>160,595,000</td>
<td>47,951,000</td>
<td>208,546,000</td>
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<tr>
<td></td>
<td>Daily</td>
<td>28,000</td>
<td>440,000</td>
<td>131,000</td>
<td>571,000</td>
</tr>
<tr>
<td>San Mateo</td>
<td>Annual</td>
<td>7,490,000</td>
<td>117,593,000</td>
<td>35,111,000</td>
<td>152,704,000</td>
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<tr>
<td></td>
<td>Daily</td>
<td>21,000</td>
<td>322,000</td>
<td>96,000</td>
<td>418,000</td>
</tr>
<tr>
<td>San Francisco</td>
<td>Annual</td>
<td>4,820,000</td>
<td>75,674,000</td>
<td>22,595,000</td>
<td>98,269,000</td>
</tr>
<tr>
<td></td>
<td>Daily</td>
<td>13,000</td>
<td>207,000</td>
<td>62,000</td>
<td>269,000</td>
</tr>
<tr>
<td>Solano</td>
<td>Annual</td>
<td>3,719,000</td>
<td>58,388,000</td>
<td>17,434,000</td>
<td>75,822,000</td>
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<tr>
<td></td>
<td>Daily</td>
<td>10,000</td>
<td>160,000</td>
<td>48,000</td>
<td>208,000</td>
</tr>
<tr>
<td>Marin</td>
<td>Annual</td>
<td>2,178,000</td>
<td>34,195,000</td>
<td>10,210,000</td>
<td>44,405,000</td>
</tr>
<tr>
<td></td>
<td>Daily</td>
<td>6,000</td>
<td>94,000</td>
<td>28,000</td>
<td>122,000</td>
</tr>
<tr>
<td>Sonoma</td>
<td>Annual</td>
<td>2,636,000</td>
<td>41,385,000</td>
<td>12,357,000</td>
<td>53,742,000</td>
</tr>
<tr>
<td></td>
<td>Daily</td>
<td>7,000</td>
<td>113,000</td>
<td>34,000</td>
<td>147,000</td>
</tr>
<tr>
<td>Napa</td>
<td>Annual</td>
<td>93,000</td>
<td>1,460,000</td>
<td>436,000</td>
<td>1,896,000</td>
</tr>
<tr>
<td></td>
<td>Daily</td>
<td>250</td>
<td>4,000</td>
<td>1,000</td>
<td>5,000</td>
</tr>
<tr>
<td><strong>All</strong></td>
<td>Annual</td>
<td>72,991,000</td>
<td>1,145,959,000</td>
<td>342,161,000</td>
<td>$1,488,120,000</td>
</tr>
<tr>
<td></td>
<td>Daily</td>
<td>200,000</td>
<td>3,140,000</td>
<td>937,000</td>
<td>$4,077,000</td>
</tr>
</tbody>
</table>

Notes:
- Cost of lost time assumes: total delay x $15.70 per hour; average vehicle occupancy of 1.15; nine percent truck volume; and 4% real discount rate.
- Cost of wasted fuel = wasted fuel (gallons) x $2.727 a gallon.
- Wasted fuel (gallons) = total delay in VHD x 1.719 for each vehicle hour of delay.
- Figures may not add up exactly due to rounding.
Transportation Management System
California Department of Transportation
Embracing Transportation System Management & Operations (TSMO)

• Mobility Pyramid established in early 2000’s with foundation on maintenance & system management

• Performance as the basis for investment decisions

• Updated Mission, Vision & Goals and Strategic Management Plan

• “Fix it First” (TSMO) Philosophy

Mission
Provide a safe, sustainable, integrated and efficient transportation system to enhance California’s economy and livability

Vision
A performance-driven, transparent and accountable organization that values its people, resources and partners, and meets new challenges through leadership, innovation and teamwork
California Focus Areas
Transportation System Management & Operations (TSMO)

- Transportation Management System
  - Build-out (TMS)
  - Adaptive Ramp Metering

- Emergency Management
  - System Monitoring & Performance Measurement
  - Incident Management & Disaster Planning
  - Traveler Information (Regional & Statewide)

- Integrated Corridor Management
  - Integrated Freeway & Arterial Operations
  - Transit/Rail, Pedestrians, & Bicyclists

- Operational Improvements & System Completion
  - Express or High Occupancy/Toll Lanes
  - Strategic Improvements

- Embrace New Technology
  - Connected/Automated Vehicles & Infrastructure
Traffic Management Systems (TMS) for Improved Mobility

- CCTV Cameras
- Detection Stations
- Ramp Meters
- CCTV Cameras
- Changeable Message Signs
- Highway Advisory Radios
- Planned Highway Work
- Coordinated Emergency Response

- 511 Traveler Information (Regional)
- Caltrans Quickmap (Statewide)
- Caltrans Quickmap (Statewide)
# California Transportation Management System (TMS)

## Inventory

<table>
<thead>
<tr>
<th>System</th>
<th>Statewide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Signals</td>
<td>6,263</td>
</tr>
<tr>
<td>Closed Circuit TV Cameras (CCTV)</td>
<td>2,821</td>
</tr>
<tr>
<td>Changeable Message Signs (CMS)</td>
<td>897</td>
</tr>
<tr>
<td>Highway Advisory Radio (HAR)</td>
<td>188</td>
</tr>
<tr>
<td>Extinguishable Message Sign (EMS)</td>
<td>585</td>
</tr>
<tr>
<td>Vehicle Detection Stations (VDS)</td>
<td>17,723</td>
</tr>
</tbody>
</table>

### Notes:
- CCTVs includes freeway and arterial signal cameras.
- CMSs include larger informational display boards & smaller variable message signs.
- EMSs include informational message signs and curve warning signs.
- VDSs include freeway mainline, connectors, & on- & off-ramps.
San Francisco Bay Area
Ramp Metering  (Various Stages of Development)

- Ramp Metering is a key element of the TMS, and continues to grow.

- As an Example, in the next two years, the existing 618 active ramp meters in the Bay Area are expected to grow by 14% to 706, and then more than double in the future as funding becomes available.

Note: The estimated cost to complete the system is +$1.1B.
## San Francisco Bay Area
### TMS Performance & Health

<table>
<thead>
<tr>
<th>TMS Element</th>
<th>August 2012</th>
<th>April 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inventory</td>
<td>Performance</td>
</tr>
<tr>
<td>Changeable Message Sign</td>
<td>128</td>
<td>69%</td>
</tr>
<tr>
<td>Closed Circuit TV Camera</td>
<td>353</td>
<td>43%</td>
</tr>
<tr>
<td>Ramp Meter</td>
<td>347</td>
<td>97%</td>
</tr>
<tr>
<td>Vehicle Detection Station</td>
<td>2,334</td>
<td>47%</td>
</tr>
<tr>
<td>Vehicle Sensors (Lane)</td>
<td>7,533</td>
<td>48%</td>
</tr>
</tbody>
</table>

### Notes:
- **Performance Target:** 80% or better (*90% or better by 2020*)
- **Additional State SHOPP funds invested $19M (2013 – 2016)**
- **System Degradation is currently at less than 4% of inventory per month.**
- **Continued Investment:**
  - MTC I-880 Performance-based TOS Device Maintenance Contracts ($12M, 2016-21)
  - $65.7 M SHOPP funds programmed for TMS Health (2018-25)
    - 2016 SHOPP Detection Repair ($30M, 2018 or later)
    - 2018 SHOPP Asset Management Pilot ATMS Upgrade Project ($3.7M, 2020-25)
    - 2016 SHOPP Detection Life Cycle Replacement ($16M, 2022)
Incident & Emergency Management
Caltrans/CHP Goal:
Clear major highway incidents within 90 minutes or less (achieved for 75% of incidents in FY 2015/16).

<table>
<thead>
<tr>
<th>CHP CAD: INCIDENTS REPORTED PER DAY</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>total “incidents” reported</td>
<td>4000</td>
</tr>
<tr>
<td>traffic hazard reports</td>
<td>165</td>
</tr>
<tr>
<td>accident reports</td>
<td>140</td>
</tr>
<tr>
<td>reports reviewed by Caltrans</td>
<td>300</td>
</tr>
<tr>
<td>reports involving Caltrans field activities</td>
<td>270</td>
</tr>
<tr>
<td>reports requiring action by TMC</td>
<td>69</td>
</tr>
</tbody>
</table>

24/7 TMC
- Caltrans Communications Center and Traffic Operators
- California Highway Patrol
- MTC-511 Travel Information
Emergency Operations through pre-planning & coordination among multiple agencies with defined roles & responsibilities.

Caltrans Inter-regional, Regional, and Satellite TMCs.

Caltrans Emergency Operations Centers (EOCs) are activated as a separate unit in response to incidents regionally impacting transportation mobility.
Freeway Operations
Many congested urban corridors
- commute/recreational/freight traffic
- Significant incident patterns
- Ridesharing & Transit Integration

Widening no longer always viable.

Must use technology to make existing transportation system more efficient.

Integrated Corridor Management (ICM)
- I-80 Smart Corridor (Alameda/Contra Costa Co.)
- US 101 Smart Corridor (San Mateo County)
- Interstate 880 ICM (Alameda County)
- Interstate 680 Forward (Contra Costa County)
- Interstate 210 ICM Pilot (Los Angeles County)
San Francisco Bay Area: Integrated Corridor Management

I-80 Smart Corridor

Active Traffic Management Toolbox:

- **20-Mile Freeway segment, fully outfitted with ITS elements:**
  - Vehicle Detection Stations
  - Closed Circuit TV Cameras
  - Electronic Changeable Message Signs
  - Variable Advisory Speed Signs
  - Information Display Board
  - Adaptive Ramp Meters (5 a.m. - 8 p.m., including weekends)
  - Highway Advisory Radios

- **Arterial Elements**
  - Interconnected Signal Systems
  - CCTVs at Traffic Signals
  - Transit Signal Priority
  - System Detectors
  - “Trailblazer” Signs

- **Results, promising!**
  - Official After-study expected in Fall 2017
San Francisco Bay Area: Integrated Corridor Management

I-80 Smart Corridor

Freeway: Electronic signs on overhead gantries turn ON upstream of an incident, and immediately past.

Activations: 155
WB I-80: 107
EB I-80: 46
Typ. Duration: 30’

8/25/16 to 4/1/17

Arterial: Trailblazer Signs turn ON and signal “flush plan” implemented along main arterial to guide traffic back to freeway.
California
High Occupancy Vehicle (HOV) Lanes

- **Existing**: 1,515 Miles
- **Under Construction**: 63 Miles
- **Proposed/Programmed**: 695 Miles
- **Future**: 2,273 Miles

Lane Miles

<table>
<thead>
<tr>
<th>City</th>
<th>Lane Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sacramento</td>
<td>100</td>
</tr>
<tr>
<td>San Francisco</td>
<td>150</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>500</td>
</tr>
<tr>
<td>San Bernardino</td>
<td>200</td>
</tr>
<tr>
<td>Stockton</td>
<td>100</td>
</tr>
<tr>
<td>San Diego</td>
<td>50</td>
</tr>
<tr>
<td>Orange County</td>
<td>250</td>
</tr>
</tbody>
</table>
California Express (or HOV/Toll) Lanes

- **Existing:** 250 Miles
- **Under Construction:** 58 Miles
- **Proposed/Programmed:** 1,250 Miles

**Future:** 1,558 Miles
Freeway Operations in rural areas are more focused on safety and responding to changing conditions, such as:

- Weather (snow; chain controls)
- Wildfires
- Mud or Rock Slides
- Floods
- Major crashes, particularly involving trucks

Providing accurate timely, and reliable traveler information is the primary objective, in addition to efficient response to incidents.
Commercial Vehicles Operations
Caltrans works with the trucking industry, California Legislature, California Highway Patrol (CHP), and the US Department of Transportation to provide a safe & efficient environment for commercial vehicle operations on California roadways.

- **Truck routes** are reviewed and selected based on truck volumes, absence of alternate routes, length of detour, and time savings.

- **127 Commercial Vehicle Enforcement Facilities (CVEF)** at major ports of entry and rural routes with high truck traffic for inspection of safety systems, size/weight compliance, and driver vehicle credentials.

- **137 Weigh-in-Motion (WIM) sites** with sensors embedded in the roadway to capture and record axle weights and gross vehicle weights as vehicles drive over them at a reduced or normal traffic speed. Truck axle weight data are collected for reporting, structure analysis, freight traffic modeling, highway performance monitoring, and immediate enforcement by the CHP.

- **Pre-Pass** uses WIM data for electronic screening & clearance system for qualifying motor carriers that meet compliance criteria, allowing trucks to bypass the adjacent CVEF.

- **Bridges & overpasses** along routes are being considered for strengthening or replacement based on structure age, substandard weight rating, and vertical clearance.
California Connected Vehicles Test Bed
In 2005, Caltrans and MTC created the first locally funded CV Test Bed on State Route 82 (El Camino Real), in Palo Alto.

Today, the following 11 intersections along a 2-mile long segment are equipped with DSRC radios broadcasting SPAT and MAP messages: Stanford; Cambridge; California; Page Mill; Portage/Hansen; Matadero; Curtner; Ventura; Los Robles; Maybell; Charleston.
Pedestrians/Bicycles
Pedestrians and bicyclists need to be able to safely use and cross highways and freeway interchanges.

- Various related guides:
  - Main Street, California Guide
  - Complete Streets Policy
  - Active Transportation Program
  - “Yes We Can” Brochure for bicycle and pedestrian accommodating designs that can be used on California Highway System
  - Statewide Bicycle and Pedestrian plan, Under development; District 4 Bike Plan to include list of prioritized projects underway

- Caltrans Changing Culture from “design standards” to “flexible or practical design”.

- Caltrans Changing Culture from “design standards” to “flexible or practical design”.
Transit & Rail
### San Francisco Bay Area Transit & Rail

**29 Transit Agencies, including:**
- Bay Area Rapid Transit (BART)
- Caltrain
- San Mateo County Transit District (SAMTRANS)
- Alameda Contra Costa County Transit (ACTransit)
- Santa Clara Valley Transportation Authority (VTA)
- San Francisco Municipal Transportation Agency (MUNI)
- Golden Gate Bridge Highway & Transportation District
- West Contra Costa County Transit (WESTCAT)

**Two Bus Rapid Transit projects underway**
- San Francisco, Van Ness Avenue (U.S. 101/SR1), 3 mile
- International Bl/E. 14th Avenue (SR185), 9.5 mile

**Sonoma – Marin Area Rail Transit** (nearly completed)

**Caltrain Electrification & BART Extension**

**Tech Firm Shuttles/Bus Services** (Google, Genentech, etc.)

**Mobility Companies** (Uber, Lyft, & other)

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There is an increasing interest to consider freeway part-time lanes and bus-on-shoulder operations.
Challenges
San Francisco Bay Area
Population, Housing, Jobs, & Transportation

- Plan Bay Area 2040, a blueprint for regional growth and transportation investment to be adopted in July 2017.

- Where will the region plan for the 820,000 new households?

- Where will the region plan for the 1.3 million new jobs?

- How will the limited available Transportation funds be invested?

Plan Bay Area 2040
2.6 million households rise to 3.4 million

3.4 million Jobs rise to 4.7 million
San Francisco Plan Bay Area 2040

Funding Distribution in Year-Of-Expenditure

- Transportation investments that preserve the existing infrastructure & support economic development, and resiliency.

90% Operate, Maintain, and Modernize

10% Expand Existing System

Total = $303 Billion
• Emphasis on sustainability & resilience

• Collaborative Efforts
  - 2011, Adapting to Rising Tides: Transportation Vulnerability and Risk Assessment Pilot Project (Caltrans, MTC, & BCDC)
  - 2014, Climate Change and Extreme Weather Adaptation Options for Transportation Assets in the Bay Area (Caltrans, MTC, BCDC, BART)
  - 2016, State Route 37 Integrated Traffic, Infrastructure and Sea Level Rise Analysis (UC Davis)
  - A Resilient Transportation System for Safe and Sustainable Communities (Caltrans, BART, MTC, BCDC)
  - Underway: Caltrans District 4 Climate Change Vulnerability Assessment (Caltrans HQ Climate Change Branch)
A Simplified Overview of California Transportation Funding

[Diagram showing various funding sources and their interconnections within the transportation system in California]
2016 State Highway Operation & Protection Plan (SHOPP)

Needs Assessment - $86.5 B

- Escalation $16.4
- Safety $13.3
- Stewardship $13.3
- Sustainability $13.3
- System Performance $9.9

Investment Plan - $26.6 B

- Stewardship 67%
- System Performance 6%
- Sustainability 10%
- Escalation 17%

Fix it First.
Opportunities
• SB 1- Road Repair and Accountability Act of 2017 provides significant additional funds in the form of tax and fee increases.

- $7.3 B by increasing diesel excise tax 20 cents;
- $3.5 B by increasing diesel sales tax to 5.75%;
- $24.4 B by increasing gasoline excise tax 12 cents;
- $16.3 B by an annual transportation improvement fee based on a vehicle’s value;
- $200 M from an annual $100 Zero Emission Vehicle fee (commencing in 2020);
- $706 M in General Fund loan repayments;
- TOTAL: $52.406 Billion
  - $25.9 Billion for State Highway System and Other Infrastructure.
  - $26.6 Billion for Local Streets and Roads
- Amounts identified are over 10 year figures but the Tax/fee increases are permanent.

• California Road User Charge Pilot

Source: California Governor’s Office
San Francisco Bay Area Express Lanes Network

Working with MTC and local partners to expand and convert HOV lanes into an Express Lanes Network

- Optimizes use of the existing system.
- Improved mobility for all, utilizing available unused capacity in HOV Lanes.
- Dynamic pricing controls demand & preserves ridesharing incentives.
- Added Choice & Reliability.
- Enhanced Environment.
- New funding source to close gaps in network, to provide additional time savings and incentives for transit & carpools.

Existing, 45 Miles
By 2020, 150 “
By 2030, 200 “
Beyond, 150 “
2017 State Highway System Management Plan
- Integrates 10 Year SHOPP & five-Year Maintenance Plans.
- Aligns objectives with Caltrans Strategic Plan
- Transparency

Implements Performance Management (of physical assets)
- Use individual objective management systems
- Use deterioration rates, service life estimates, & expert judgement
- Establish condition targets & determine condition gaps
- Determine unconstrained need & develop a constrained investment plan
- Distribute funding for objectives based on a statewide performance target (not $’s) in proportion to each objective performance gap for each district
- If a District has achieved the statewide goal, their target will be zero.
- Balance work across all objectives
- Fiscal targets are set for a 5 year period and included in 10 Year SHOPP
California Connected Corridors Program

- Caltrans intends to utilize Capability Maturity Model as a tool to support ICM:
  - Regional Operations Workshops to evaluate capabilities by corridor for integrated management
  - Move from separate ad-hoc processes towards mature, cross functional, integrated and optimized operations.

- Focus to be on transportation corridors with maximum peak travel time delay.

- Caltrans Strategic Management Plan commits to ICM implementation:
  - By 2018, five corridors (SR-57, I-80, SR-91, I-110, 210)
  - By 2020, three corridors (SR-57, I-80, I-210)
Next Steps: CVO Issues, Challenges, & Recommendations

• **Congestion and delays:** Congestion in the urban areas is also a challenge for commercial vehicles which need to be considered as part of mobility improvements, integrated & connected corridors, express lanes, traveler information.

• **Hours of service:** Fatigue is a big issue facing drivers and a major cause of crashes; recommend stricter enforcement on the hours of operations.

• **Parking shortage:** Parking shortages at rest areas and near the origin/destination is an issue; recommend building more truck-friendly parking facilities.

• **Safety Awareness/Education:** Drivers still need to be made aware of the operational limitations of commercial vehicles traveling on the highway. Crashes involving commercial vehicles tend to be more severe and result in greater loss of life than those involving only passenger cars.
Next Step: Connected Vehicles

- Connected Vehicles use vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication technology to provide information, alerts, and if necessary, warnings to drivers that enable them to travel safely and more efficiently.

- On freeways, end-of-queue warnings using V2V can address 50% of the crashes.

- V2I can alert drivers to slow or stopped traffic just ahead of them.
Next Steps: Automated Vehicles

- Machines perform the same functions that are currently performed by human drivers.
- Intuitively, machines should not ever be distracted or inattentive, so they should be safer.
- Improvements to signing and striping on freeways will help machine vision systems.
- While not full vehicle automation, truck platooning, using cooperative adaptive cruise control technology, is gaining momentum.
Next Steps: Active Traffic Management

- Supplementing ICM, Active Traffic Management includes Coordinated Ramp Metering (CRM) and Variable Speed Limits (VSL).

- After analyzing the corridor’s traffic patterns using simulation and modeling tools, optimal plans are determined for CRM and VSL that squeeze more efficiency out of the existing freeway.

- Using V2I, vehicle speeds can be controlled to delay or even eliminate the onset of stop-and-go driving.
Predictions, anyone?

- **By 2020**, 50% of mobility as a service rides will be via autonomous vehicles.
- **By 2025**, no one will own a car; we’ll be able to ride Hyperloop; there will be 88 Smart Cities worldwide.
- **By 2029**, 146 million vehicles in the US will have connected vehicle technology.
- **By 2040**, you can travel by Hypersonic Jet.
- **By 2045**, there will be buildings 18-24 miles high; flying cars will exist in the near future. Connected/Autonomous vehicles will eliminate the need for roadway sensors, all roadway signage, traffic signals, etc.

Source: California PATH 30th Anniversary Event
Questions?

Safety

Mobility
Bicycle-Pedestrian Bridge, Across Interstate 80/580, Berkeley, CA
Completed: 2002

Bay Bridge Bicycle-Pedestrian Path, Across Interstate 80, Oakland, CA
Completed: 2013/16

Richmond-San Rafael Bridge Bike Path with Moveable barrier on shoulder
Estimated Completion: Spring 2018
Old Redwood Highway at U.S. 101
Raised crosswalk & bike lane at ramp
Status: Completed 2014

Alpine Road bike lanes
across I-280 ramp crossings
Status: Completed in 2013

San Pablo Avenue (SR 123)
Two-way raised cycle track
Status: In Construction
San Francisco Bay Area
Innovative Pedestrian & Bicycle Facilities

Sloat Boulevard (State Route 35), San Francisco:

- “Road Diet” from six to four lanes
- New Bicycle lanes with buffer
- Speed & Crash Reduction
• Active Transportation Program (ATP) 2017- Cycle 3
  - District 4 (Statewide ATP): $31.76 M (of $131.76 M)
  - MTC (Regional ATP): $22.171 M

• New Senate Bill 1 Provisions:
  - $100 million/year for ATP

Oakland - Fruitvale Alive Gap Closure

Vallejo - Bay Trail/Vine Trail Gap Closure
San Francisco Bay Area: Integrated Corridor Management
San Mateo US 101 Smart Corridor

- $35.3 M project for Enhanced Congestion Monitoring & Management
- 20-mile freeway stretch through 10 cities in San Mateo County
- New & upgraded field elements and communication
- State & local TMCs + remote operations
- “Smart Corridor Routes”: Local arterials & State Routes 82, 84, 109, 114
• 32 mile corridor in Alameda & Santa Clara Counties, including nine cities

• Segment 1 focuses on arterial improvements for incident management.
  - Improved Arterial Incident Management
  - ITS components: trailblazer signs, CCTV, detection stations, signal coordination, and communications improvements
  - Parallel State Arterials: SR 61 (Davis Street & Doolittle Drive), SR 77 (42nd Avenue), SR 112 (Davis Street), & SR185 (International Blvd).
  - Project Cost: $14M
  - Completion: 2019

• Future Segments 2 and 3 are in Alameda County and Segment 4 would extend to Santa Clara County.
San Francisco Bay Area: Integrated Corridor Management

State Route 4 Smart Corridor

- Approximately 30 miles from I-80 to SR-160 through seven cities
- In Early planning stage
- 18 month schedule: Prepare Concept of Operations & High Level System Requirements for:
  - Corridor Ramp Metering
  - Incident Management
  - Travel Demand Management
Contra Costa County I-680 Forward

- 25 mile Corridor, from Benicia-Martinez Bridge to Alameda County Line
- Corridor Ramp Metering
- Incident Management
- Bus on Shoulder Use
- First Mile/Last Mile, including Autonomous/Connected Vehicles,
- Travel Demand Management
California Integrated Corridor Management
Interstate 210 ICM Pilot

- 11.5-mile corridor, between SR-134 in Pasadena to I-605 in Duarte, including:
  - Fragmented Arterial signal systems & modal operations
  - Advanced Ramp metering Operations, light-rail, and several transit operators
  - A multitude of express commuter transit and distributed parking facilities
  - Excellent freeway detection and communication system

- Project features:
  - Improved real-time system monitoring capabilities
  - Improved incident response coordination
  - Improved traffic and demand management applications
  - Optimized corridor operations in real-time

- Completion Date:
  - Freeway ITS Improvements: March 2018
  - Arterial improvements & Decision Support System (DSS) : 2018

- Cost: $ 26.4 M
San Francisco Bay Area
Van Ness Avenue (US 101) BRT

- San Francisco’s first BRT
- 3-mile corridor
- Converts one of three existing lanes in each direction to a dedicated bus lane
- Showcases Caltrans’ Main Streets and Complete Streets policies
- Other features:
  - Replaces MUNI’s Overhead Contact System;
  - Upgrades of Traffic signal system and street lighting;
  - Replacement of Water, Sewer and Auxiliary Water Supply System

- Completion date: March 2020
- Project Cost: +$273 M
San Francisco Bay Area
East Bay Bus Rapid Transit

- 9.5-mile alignment on International Boulevard/E. 14th Street (SR 185), from Uptown Oakland to San Leandro BART Transit Center

- A combination of 80% dedicated bus-only & mixed-flow lanes

- Includes 34 stations (46 total platforms at 21 median, 12 curbside & 1 southern terminal)

- 27 hybrid-electric buses (low-emission, 60-foot articulated)

- Pedestrian scale lighting & visibility

- New traffic & pedestrian signals with transit priority

- Best ADA Practices & level boarding

- Bike Racks at platforms and inside the bus

- Same fare as local service (with 7 to 8 minute headways for increased frequency and reliability)

- Revenue Service Date: Anticipated 2018
San Francisco Bay Area
Sonoma-Marin Area Rail Transit (SMART)

- SMART is a voter-approved passenger rail and bicycle-pedestrian pathway
- 70-mile corridor from Larkspur to Cloverdale
  - Phase 1: 43-mile route from San Rafael to Santa Rosa, including 10 stations, and 2 planned future stations
  - Phase 2: Remainder, including five planned stations
- Train service between Sonoma County Airport and San Rafael is scheduled to begin in late Spring 2017
- First rail agency to use Positive Train Control technology, enhancing safety & service reliability along the corridor
- Made in the USA: Trains, Rails, Ties, & Ballast produced domestically
- SMART contracts have put >$24M into the local economy
<table>
<thead>
<tr>
<th>Project Description</th>
<th>Begin Construction</th>
<th>Expected Opening</th>
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</thead>
<tbody>
<tr>
<td>Alameda/Santa Clara I-680 (Southbound)</td>
<td>2008</td>
<td>Opened 9/20/2010</td>
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<tr>
<td>Santa Clara 880/237 (Connectors)</td>
<td>2011</td>
<td>Opened 3/20/2012</td>
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<tr>
<td>Eastbound Alameda I-580</td>
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<td>Opened 2/19/2016</td>
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<tr>
<td>Westbound Alameda I-580</td>
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<td>Contra Costa 680</td>
<td>2015</td>
<td>2017</td>
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<td>Santa Clara State Route 237</td>
<td>2017</td>
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<td>Alameda I-880</td>
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<tr>
<td>Alameda I-680 (Northbound)</td>
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<td>2019</td>
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<td>Alameda 84 &amp; 92</td>
<td>2017</td>
<td>2020</td>
</tr>
<tr>
<td>Solano I-80</td>
<td>2018</td>
<td>2021</td>
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<td>Alameda I-80</td>
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<tr>
<td>Santa Clara State Route 85</td>
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California Department of Transportation
Climate Change

• Recent 2017 storms: 21 Bay Area vulnerable locations

<table>
<thead>
<tr>
<th>County</th>
<th>Repair Costs</th>
<th>Number of Incidents</th>
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<tbody>
<tr>
<td>Alameda</td>
<td>$37,425,000</td>
<td>37</td>
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<tr>
<td>Contra Costa</td>
<td>$8,805,000</td>
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<td>Marin</td>
<td>$104,071,000</td>
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<td>Napa</td>
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<td>Santa Clara</td>
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<td>San Francisco</td>
<td>$675,000</td>
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<td>San Mateo</td>
<td>$68,045,000</td>
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<td>Solano</td>
<td>$17,480,000</td>
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<td>Sonoma</td>
<td>$39,975,000</td>
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<tr>
<td>Total</td>
<td>$375,841,000</td>
<td>465</td>
</tr>
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• Caltrans Green Fleet & Green Building Measures
• ZEV 30-30: Charging Stations at 30 locations in 30 months (Park & Ride Lots, and Maintenance Stations)
• Water Savings: Smart controllers for landscaping irrigation & Recycled Water
• Recycled construction materials (asphalt and concrete)
• LEED Gold Certified, SFOBB Maintenance Complex
• Implosion project at SFOBB
  ➢ (Construction Manager General Contractor hired micro-blasting sub minimized water pollutant and reduced Carbon footprint.)
Over the next 30/40 years, California will add the current population of New York state to its current 38 million residents.

First high speed rail (HSR) system in the nation, California HSR will connect mega-regions, contribute to economic development & a cleaner environment, create jobs and preserve agricultural and protected lands.

By 2029, the system will run from San Francisco to the Los Angeles basin in under three hours at speeds over 200 MPH.

HSR will eventually extend to Sacramento and San Diego, totaling 800 miles with up to 24 stations.

ENVIRONMENTAL/QUALITY OF LIFE BENEFITS

- Tree planting and other programs will result in about 520,000 tons of GHG reductions.
- In first year of operation HSR will take the equivalent of 31,000 passenger vehicles off road.
- Caltrain electrification program will reduce an estimated 68 thousand tons of CO\textsuperscript{2} a year starting in 2019.